REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application.

Disposition of Claims

Claims 1-4 and 7-9 are pending in this application. Claims 5 and 6 are cancelled. Claims 1, 7, and 8 are independent. Claims 2-4, and 9 depend, directly or indirectly, from claims 1, 7, or 8.

Rejection(s) under 35 U.S.C § 112

Claims 7 and 9 stand rejected under 35 U.S.C. § 112 as lacking proper antecedent basis. Claims 7 and 9 have been amended to correct for the lack of antecedent basis. This amendment is not made for reasons of patentability, and no new matter is added. Accordingly, withdrawal of this rejection is respectfully requested.

Rejection(s) under 35 U.S.C § 103

Claims 1-2 and 8 stand rejected under 35 U.S.C. § 103(a) as unpatentable over the translation of Japanese publication number 05-158515 ("Hisao") in view of U.S. Patent No. 4,776,247 ("Kiya"). The rejection of claims 1-2 and 8 is respectfully traversed because, in view of the above amendments, the cited art does not teach or suggest all of the limitations found in the independent claims.

Claim 1, as amended, recites a control apparatus for numerical control of a cutting

machine including a turret that is rotatable about a turret axis, and a cutting tool that is attached to the turret and rotatable about a tool axis. An X-axis value (L2r) of a cutting edge of the cutting tool when the cutting tool is rotated about the tool axis to a tool rotation angle (β) is calculated. An X-axis offset value (ΔXr) and a Z-axis offset value (ΔZr) when the turret is turned to a turret rotation angle (α) are also calculated. The X-axis offset value (ΔXr), after the rotation of the cutting tool, and the Z-axis offset value (ΔZr), after the rotation of the cutting tool, are indicated on a display.

As a result of the claimed structures, the invention has the advantages of not only providing a control apparatus for a cutting machine in which a turret turns around an axis, but, in addition, providing a control apparatus for the cutting machine in which the cutting tool rotates around the tool axis. Because this invention uses automatically indexes and controls both the position of the turret and the cutting tool, the operator of the cutting machine no longer has to hand-calculate offset values according to the position of the turret after a rotation. This has typically been considered a difficult task for the operator and as a result has increased the potential risk of miscalculation. The calculated offset values are displayed so that the operator merely has to monitor the position of the cutting tool.

Claim 8, as amended, recites a control apparatus for numerical control adapted for a cutting machine in which a cutting tool is rotated around the tool axis to an arbitrary position. A Y-axis offset value (ΔY) of a cutting edge of the cutting tool on a coordinate with respect to the cutting machine is calculated in accordance with a rotation angle of the cutting tool, and the Y-axis offset value is indicated on a display.

The invention recited in claim 8, like that in claim 1, has advantages that provide

for a control apparatus that numerically controls a cutting machine in which the cutting tool is rotated around not only the turret axis but the tool axis as well. In addition, the invention mathematically determines the Y-axis offset value of the cutting edge of the cutting tool, making it unnecessary to hand-convert the offset value after rotation of the cutting tool and/or turret. The Y-axis offset value of the cutting edge is displayed in order for the operator to monitor the position of the cutting edge and ensure a proper cutting process.

Hisao only discloses a control apparatus for a cutting machine having a turret that can be turned to an arbitrary position by rotating the tool around a B-axis (that is, a rotation of the turret). The turret axis, of course, is a different axis from the tool axis. The tool axis (shown in Fig. 7 of the current application) means the axis of the cutting tool, which is perpendicular to the B-axis of the turret (shown in Fig. 8 of the current application). Hisao does not show or suggest a control apparatus that can numerically control a cutting machine capable of rotation about both a turret axis and a cutting tool axis.

Kiya teaches a control apparatus whereby offset values are displayed on a screen, however Kiya does not show or suggest a control apparatus that can numerically control a cutting machine capable of rotation about both a turret axis and a cutting tool axis. It is the ability of the present invention to calculate the offset values when the cutting tool rotates about both the turret axis and the tool axis in order to numerically control the cutting process, taken with the remainder of the claims as a whole, that distinguishes it from the prior art. Displaying the offset values merely allows the operator to monitor the position of the cutting edge and in turn monitor the cutting process.

In short, in contrast to the prior art and based on the above amendments, the claimed invention numerically calculates and controls the offset values of the cutting edge while the cutting tool is rotated around both the turret axis and the tool axis to an arbitrary position. The claimed invention further allows for the arbitrary position of the cutting edge, with respect to the rotation of both the turret and the tool, to be monitored on a display in order that the operator of the cutting machine may monitor the position of the cutting edge and in turn the cutting process.

As discussed above, the present invention reduces the risk of miscalculation through simplification of the cutting machine operator's task. The invention accomplishes this by making it unnecessary to hand-convert the offset values of the cutting edge of the tool after rotation, to an arbitrary position, about not only the turret but the tool axis as well.

Neither Haiso nor Kiya, whether considered separately or in combination, show or suggest the claimed invention. Thus, claims 1 and 8 are patentable over the cited art. Dependent claim 2 stems directly or indirectly from independent claim 1 and is therefore patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 3-4, 7, and 9 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Hisao and Kiya in view of the translation of Japanese publication number 2000-141164 ("Naoki"). The rejection of claims 3-4, 7 and 9 are respectfully traversed because, in view of the above amendments, the cited art does not teach or suggest all of the limitations found in the independent claims.

Claim 7, as amended, recites a control apparatus for numerical control adapted for

a cutting machine in which a cutting tool is rotated around the tool axis thereof to an arbitrary position. An X-axis value (L2r) of a cutting edge of the cutting tool on a coordinate with respect to the cutting machine is calculated in accordance with a rotation angle of the cutting tool. An X-axis offset value (ΔXr) after the rotation is obtained from equations employing the X-axis value of the tool (L2r) and an X-axis value of a turret (L4) and the X-axis offset value (ΔXr) after the rotation is indicated on a display.

The invention recited in claim 7, like that in claim 1 and 8, has advantages that provide for a control apparatus that numerically controls a cutting machine in which the cutting tool is rotated around not only the turret axis but the tool axis as well. In addition, the invention mathematically determines the X-axis value and the X-axis offset value of the cutting edge of the cutting tool, making it unnecessary to hand-convert the offset value after rotation of the cutting tool and/or turret. The X-axis offset value of the cutting edge is displayed in order for the operator to monitor the position of the cutting edge and ensure a proper cutting process.

Hisao discloses an apparatus that can compute X-axis offset values. However, Hisao does not show or suggest a control apparatus that can numerically control a cutting machine capable of rotation about both a tool axis and a turret axis.

Naoki teaches a control apparatus whereby X-axis and Z-axis values of a turret are indicated. However, even if it may have been true at the time that one of ordinary skill in the art would appreciate that these values could be used to numerically determine the position of the cuttung edge, Naoki does not show or suggest a control apparatus that can numerically control a cutting machine using these values. And, in particular, Naoki does not show or suggest a control apparatus that can numerically control a cutting

machine capable of rotation about both a turret axis and a cutting tool axis.

Kiya, as indicated above, is relevant only to display of values and does not show or suggest a control apparatus that can numerically control a cutting machine capable of rotation about both a turret axis and a cutting tool axis.

Neither Haiso, Kiya nor Naoki, whether considered separately or in combination, show or suggest the claimed invention. Thus, claim 7 is patentable over the cited art.

Dependent claims 3-4 and 9 stem directly or indirectly from independent claims 1, 7 and 8 and are therefore patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

CONCLUSION

Applicant believes this reply to be fully responsive to all outstanding issues and place this application in condition for allowance. If this belief is incorrect, or other issues arise, do not hesitate to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-059 (Reference Number 04995/045001).

Respectfully submitted,

Date: August 25, 2003

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